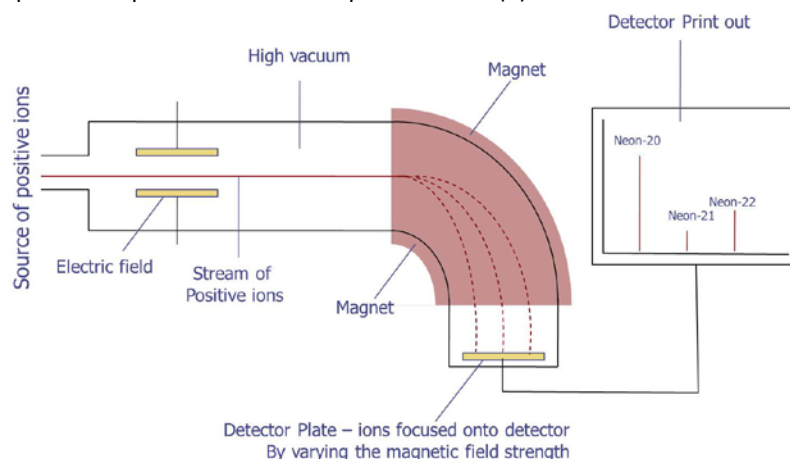


**T02D02 – (2.2) Mass Spectrometry, Percent Composition, Empirical/Molecular Formulas**

Name \_\_\_\_\_

1. 2.2.1 Describe and explain the operation of a mass spectrometer. (3)



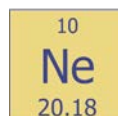
- Mass Spec:
- Now, redraw the diagram YOURSELF (for practice) and instead of labeling as above, label each of the 5 steps

- Complete the following table with an explanation for each step:

Step	Explanation
1.	
2.	
3.	
4.	
5.	

2. 2.2.2 Describe how the mass spectrometer may be used to determine relative atomic mass using the 12C scale. (2)

- What does the periodic table show you?



- What is the relative atomic mass ( $A_r$ )?
- What does it mean to state that all masses are based on carbon-12?
- Calculate the relative atomic mass of chlorine if  $^{35}\text{Cl}$  is 75% abundant and  $^{37}\text{Cl}$  is 25% abundant:
- What is an amu and what are its units?

- f. The neon element has three isotopes. They are 90.92% of  $^{20}\text{Ne}$ , 0.26% of  $^{21}\text{Ne}$  and 8.82% of  $^{22}\text{Ne}$ , find the relative atomic mass:

3. 2.2.3 Calculate non-integer relative atomic masses and abundance of isotopes from given data. (2)

- a. The relative atomic mass ( $A_r$ ) of Gallium is 69.7 g/mol. There are two stable isotopes  $^{69}\text{Ga}$  and  $^{71}\text{Ga}$ , calculate the percentage abundance of each:
- b. The relative atomic mass ( $A_r$ ) of Carbon is 12.011 g/mol. There are two stable isotopes  $^{12}\text{C}$  and  $^{13}\text{C}$ , calculate the percentage abundance of each: (assume that  $^{14}\text{C}$  is negligible)

4. 1.2.4 – Distinguish between the terms empirical formula and molecular formula

- a. Define Empirical formula and give an example:
- b. Define Molecular formula and give an example relating to part (a):

5. 1.2.5 – Determine the empirical formula from the percentage composition or from other experimental data

- a. When determining the empirical formula from mass spec data, you must follow:

1.	
2.	
3.	
4.	
5.	

- b. Determine the empirical formula of a compound with 79.9% Carbon and 20.1% Hydrogen

- i. Now find its molecular formula if the molecular mass is known to be 30.08:

- c. Provide the generic formula for calculating the percent composition of a formula:

- d. Now, prove your work in part (b) to be correct by calculating the percent composition of  $\text{C}_2\text{H}_6$ :

- e. Try another, find the percent composition of  $\text{C}_6\text{H}_{12}\text{O}_6$  (glucose):

- f. And find the empirical formula for MSG: 35.51% carbon, 4.77% hydrogen, 37.85% oxygen, 8.29% nitrogen and 13.60% sodium